

REMARKS

Claims 1-11, 14-15, 24 and 26-73, 75-78 are now pending in the application, of which claims 1, 40, 47, 50, 56 and 66 are being amended, and claim 74 is being canceled.

Applicant requests entry of the claim amendments which are fully supported by the specification and original claims and add no new matter. For example, the language "absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube" as recited in claim 1, is supported by the Specification by the paragraph bridging pages 3 and 4; page 11, lines 8-15; and the original claims.

The specification is also being amended to correct errors detected by Applicants and to secure correspondence between the claims and the specification as required by 37 CFR 1.117.

Reconsideration of the present case in view of the amendments and remarks herein is earnestly requested.

Allowed Claims

Applicant appreciates the Examiner's indication of allowance of claims 10, 11, 14, 15, 24, 26-30, 33-36, 40-73, and 75-78.

Rejections Under 35 U.S.C 102(b) of Claims 1, 2, 6, 9 and 31

The Examiner rejected claims 1, 2, 6, 9 and 31 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,137,701 to Randall S. Mundt. This rejection is traversed.

The Examiner objected to claim 74 as being dependent upon a rejected claim, but indicated that the claim would be allowable if rewritten in independent form. Claim 74 recited the language "the exhaust tube being adapted to provide a non-circuitous flow of effluent therethrough." Claim 1 is being amended to recite that "the exhaust tube is adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough." Therefore, claim 1 should now be allowable over Mundt because Mundt discloses a reaction chamber (18) comprising projections that are taught to change the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube.

In a teleconversation with the Examiner, the Examiner further cited a new reference, U.S. Patent No. 5,468,356 to Uhm. Applicant respectfully submits that claim 1, as amended, distinguishes Uhm by reciting "an exhaust tube through which the effluent may be flowed, the exhaust tube adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube." In contrast, Uhm teaches metal fragments 24 in the path of the effluent flowing through the exhaust tube. These metal fragments would cause a turbulence in the flow of effluent in the exhaust tube. Claim 1 recites that the "exhaust tube is ... adapted to provide a ... non-turbulent flow of effluent therethrough by being substantially projections or recesses ... that cause turbulence in the flow of the effluent through the exhaust tube." Thus, amended claim 1 distinguishes Uhm.

Furthermore, Uhm does not teach or suggest a "process chamber for processing a substrate ... and reducing emissions of hazardous gas," as recited in claim 1. Instead, Uhm only teaches an apparatus in which "contaminated air under atmospheric pressure ... is purified" (Abstract, emphasis added.) Uhm does not teach or make any suggestion that such an apparatus is capable of reducing hazardous gas emissions from a substrate process chamber, especially because gases are typically maintained at sub-atmospheric pressures in such chambers. Thus, it would not have been obvious to one of ordinary skill in the art to use the apparatus taught by Uhm in combination with a substrate processing chamber, and claim 1, and the claims depending therefrom are not obvious over Uhm.

Rejections Under 35 U.S.C. 103(a) of Claims 3-5, 8 and 32

The Examiner also rejected claims 3-5, 8 and 32 under 35 U.S.C. 103(a) as being unpatentable over Mundt and in view of U.S. Patent 4,735,633 to Kin-Chung Chiu.

Claims 3-5, 8, and 32 depend from claim 1. As discussed above, claim 1 recites "an exhaust tube through which the effluent may be flowed, the exhaust tube adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube". These limitations distinguish parent claim 1 from Mundt for the reasons provided above. In addition, Chiu does not make up for the deficiencies of Mundt because Chiu also teaches a projection into the exhaust tube that is a spiral electrode. Thus neither Mundt nor Chiu teach or suggest claim 1 and since claims 3-5, 8 and 32 include all of the limitations of claim 1, these claims also distinguish over the proposed combination of references.

Response to Examiner's Arguments

Contrary to the Examiner's argument, Applicants respectfully submit that the "projections or recesses" as claimed in claim 1, and as taught by the specification, are not limited to merely "surficial discontinuities" or "surface roughness." The section of the specification that is relied upon by the Examiner contains a compound sentence which originally read "in a preferred version, the exhaust tube comprises a cylinder having an internal flow surface that is parallel to the direction of the flow of the effluent through the exhaust tube, and that is substantially absent or free of projections or recesses that alter the effluent flow path or provide a non-laminar flow of effluent." In other words, this sentence teaches that the exhaust tube comprises a cylinder having an internal flow surface, and also teaches that the exhaust tube may be substantially absent or free of projections or recesses. Applicants are also amending this sentence under 37 CFR 1.117 to clarify these teachings.

CONCLUSION

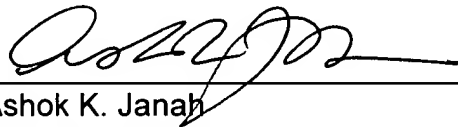
For the foregoing reasons, allowance of the instant application is respectfully requested. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES
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Date: September 20, 2001

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MARKED UP SPECIFICATION

On the paragraph bridging pages 11-12:

Preferably, exhaust tube 85 is constructed and integrated with the chamber, to provide a laminar flow of effluent through the tube that undergoes little or no turbulence that would otherwise redirect the flow of effluent in directions other than along the longitudinal axial direction of the tube. In a preferred version, the exhaust tube comprises a cylinder having an internal flow surface that is parallel to the direction of the flow of the effluent through the exhaust tube[, and that is]. The exhaust tube may also be substantially absent or free of projections or recesses that alter the effluent flow path or provide a non-laminar flow of effluent. The inner surfaces of the exhaust tube 85 comprise a surface roughness having a Reynolds number of less than about 10. The smooth-finish of the inner surface of the exhaust tube 85, in combination with a vertical orientation of the tube directly beneath the process chamber 25, as shown in Figure 2, provides a more laminar and less turbulent flow of effluent along the flow path. The laminar flow eliminates turbulence of the effluent gas flow stream and reduces the possibility that effluent gas will diffuse back into the process chamber 25. Positioning the exhaust tube 85 further downstream from the exhaust throttle valve 80, as shown in Figure 2, further reduces the possibility of a back flow of effluent gas from entering and contaminating the process chamber 25 because the pressure in the exhaust tube 85 is lower than the pressure in the process chamber. In addition, a laminar flow of effluent allows energizing radiation to be coupled in a high strength in the region immediately adjacent to the inner surface of the exhaust tube 85 to form a higher density of energized effluent gas or plasma. Also, because the effluent flows continually and uniformly past the inner surface of the exhaust tube 85, the deposition of byproducts on the inner surface, which would otherwise accumulate and impede the coupling of the ionizing radiation, make it unnecessary to frequently clean the exhaust tube 85.

MARKED UP CLAIMS FOR S/N 09/055,201

1. (amended five times) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

- (a) a support capable of supporting the substrate;
- (b) a gas distributor capable of introducing process gas into the process chamber;
- (c) a gas activator capable of activating the process gas to perform a process in the process chamber thereby forming effluent containing hazardous gas;
- (d) an exhaust tube through which the effluent may be flowed, the exhaust tube adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent^{not} projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube; and
- (e) a microwave energy applicator to couple microwaves to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent.

40. (once amended) The apparatus of claim 10 wherein the exhaust tube is substantially absent^{not} projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube.

47. (once amended) The apparatus of claim 46 wherein the sapphire comprises monocrystalline sapphire.

50. (once amended) The process chamber of claim 11 wherein the exhaust tube is substantially absent ^{of} projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube.

56. (once amended) The process chamber of claim 24 wherein the exhaust tube is substantially absent ^{of} projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube.

66. (once amended) The process chamber of claim 26 wherein the exhaust tube is substantially absent ^{of} projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, or (ii) that cause turbulence in the flow of the effluent through the exhaust tube.